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Assessing the Stability of the Core/Periphery Structure and Mobility in the Post-2008 Global Crisis Era

A World-Systems Analysis of the International Trade Network

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Abstract

How did the hierarchy of the world-system adapt to the impact of the 2008–09 global economic crisis? How did a country's position in the world-system influence their upward mobility during the crisis? This paper investigates the core/periphery hierarchy of the global trade network before and after the 2008–09 crisis. The central argument posits that the global trade network follows a core/periphery hierarchy in relation to the new international division of labor (NIDL) in the twenty-first century, and a country's placement within that hierarchy had a varying effect on their upward mobility following the 2008–09 crisis. Utilizing social network analysis of 191 countries engaged in global trade, I discover that the core/periphery structure remained unchanged after the 2008–09 global financial crisis, although many countries in intermediate positions experienced upward shifts. However, not all countries were able to achieve upward mobility, indicating that only a few semi-peripheral and peripheral countries were better positioned to improve their status compared to most non-core countries.

Keywords: Global Trade Network, 2008–09 Global Economic Crisis, Core/Periphery Structure, Mobility, Semi-Peripheral Development, Global Inequality

The global economic crisis of 2008–09, which originated in the United States and quickly spread across much of the world, was believed to have significant implications for the global capitalist system. Some interpreted the rise of the BRICS countries (Brazil, Russia, India, China, and South Africa), particularly the remarkable growth of China and India, alongside the perceived decline of U.S. and Western European hegemony, as signaling the end of Pax Americana and the emergence of a new multipolar structure of global governance (Zakaria 2008; Cooper and Flemes 2013).

Concurrently, the rapid process of globalization, characterized by the intensification of international trade and capital flows, facilitated a new international division of labor (NIDL) resulting from the expansion of global commodity or value chains across the global South (Fröbel, Heinrichs, and Kreye 1977; Gereffi 2014). Alongside the rise of the BRICS during this era of rapid economic globalization, there was a growing discussion on "global South-South cooperation," which refers to the increasing economic and political engagements among regions commonly associated with the global South (e.g., Latin America, Asia excluding Japan, the Middle East, and Africa) (Carmody 2009, 2017a, 2017b; Singh Puri 2010; Gray and Gills 2016; Mawdsley 2019).

Studies on global trade patterns after the 2008–09 crisis argued that global South-South cooperation reflected a shift in the center of gravity of global production and trade from the global North to the South (Kaplinsky and Messner 2008; Cattaneo, Gereffi, and Staritz 2010; Kaplinsky and Farooki 2013; Barrientos, Gereffi, and Pickles 2016; Horner and Nadvi 2018). In this context, the immediate and long-term effects of the 2008–09 crisis were a turning point in the global redistribution of economic influence, shifting away from the United States and Western Europe and towards the BRICS and the rest of the global South (see Pieterse 2011; Desai 2013; Kiely 2015a, 2015b, 2015c).

Conversely, some critics reject this notion and assert that this is simply a reproduction of existing capitalist development practices prevalent in the historically dominant global North (Bond and Garcia 2015; Robinson 2015). Scholars within the world-systems framework have long argued, and provided evidence to suggest, that the processes associated with the rapid globalization of recent decades have entrenched enduring inequalities within the capitalist world-economy (Arrighi 2003; Mahutga 2006; Jacobs and Rossem 2016; Zhao 2021). Major economic downturns have also been observed to exacerbate economic divergence between countries in the lower and middle tiers of the international division of labor (IDL; Mahutga and Smith 2011). Contrary to predictions that rapid globalization, along with the emergence of the BRICS and deepening global South-South cooperation, would pave the way for transformative changes following the 2008–09 crisis, an opposing argument posits that the crisis did not fundamentally challenge inequalities but, in fact, worsened them. Moreover, contrary to expectations that closer cooperation among the BRICS and the rest of the global South would be mutually beneficial, another counterargument suggests that the growth of a few countries following the crisis came at the expense of other countries. Therefore, it becomes imperative for development scholars to re-evaluate structural inequalities at the global level in the aftermath of the 2008–09 global economic crisis, considering the intertwining nature of these trends. Furthermore, a world-systems perspective offers the

necessary analytical leverage to empirically examine changes in global inequalities during an economic downturn.

The objective of this paper is to investigate the implications of the 2008–09 global economic crisis for upward mobility within the world-system. Wallerstein (1976) proposed that semi-peripheral zones exhibit faster growth than both the core and periphery during certain phases of long-term Kondratieff cycles of global economic expansion and contraction. These assertions align with previous studies that have found that nation-states occupying intermediate positions in the world-system experienced stronger upward mobility compared to those in the periphery following economic downturns in the latter half of the twentieth century (Kim and Shin 2001; Mahutga 2006; Clark 2010; Mahutga and Smith 2011). However, considering this context, few studies have examined whether a similar pattern emerged following the 2008–09 global economic crisis.

This study aims to address the following research questions: first, how did a country's position in the core/periphery hierarchy impact their upward mobility following the 2008–09 global economic crisis? And second, how did the core/periphery structure of the world-system adapt to the 2008–09 global economic crisis? To answer these questions, I employ the following analytical strategy. Firstly, I adopt a world-systems conceptualization of the semi-periphery within the core/periphery hierarchy of the capitalist world-economy, focusing on the IDL. The objective is to empirically examine the ongoing struggle of nation-states to improve their relative position in the hierarchy (Arrighi and Drangel 1986; Chase-Dunn 1988, 1990, 1997, 1998; Arrighi, Silver, and Brewer 2003). Secondly, I argue that using aggregate trade data to measure not only structural position but also mobility is better suited than examining specific commodities alone. Previous world-systems research has analyzed the core/periphery hierarchy and upward mobility within specific commodity networks (Nemeth and Smith 1985; Mahutga 2006; Mahutga and Smith 2011). However, in accordance with Arrighi and Drangel (1986),

> any activity can become core-like or periphery-like at a particular point in time, but each has that characteristic for a limited period. Nonetheless, there are always some products and techniques that are core-like and others that are periphery-like at any given time. (Arrighi and Drangel 1986: 18)

Therefore, as semi-peripheral countries exhibit a mixture of core-like and peripheral characteristics in relation to their production activities at any given time, and these activities can fluctuate between peripheral and core-like, it would be challenging to establish an empirically sound threshold for semi-peripheral states based solely on their production activities.

Subsequently, I construct and analyze international network data for 191 economies from 2007 to 2017. Third, I employ singular value decomposition (SVD) analysis on the trade data to examine mobility within two overlapping core/periphery structures: export-coreness and import-coreness. This allows for differentiation between states that are more prominent in the exporting core compared to the importing core in the world-economy, providing a better understanding of the core/periphery structure consistent with the organization of the IDL. Additionally, the 2008–09 crisis had varying effects on imports and exports. Consumer spending significantly declined,

leading to a loss of over 2.6 million jobs in the U.S. economy by the end of 2008 (U.S. Bureau of Labor Statistics 2014). The decrease in consumer spending was accompanied by a decline in production and manufacturing, resulting in a substantial drop in global economic output. However, previous empirical analyses provide a clearer understanding of how exports and imports behave following recent global financial crises. For instance, Benguria and Taylor (2019) studied the history of international trade flows during financial crises and identified a consistent pattern of contracting imports, while levels of exports remained stable or even grew in certain cases.

The contribution of this paper to the existing literature is that, to the best of my knowledge, few empirical analyses of the core/periphery structure have addressed structural mobility in imports and exports. This study provides analytical leverage by examining the struggle of countries to improve their position within two interdependent core/periphery structures of the capitalist world-economy during a recent period of economic downturn. A key finding is that, despite the impact of the 2008–09 global economic crisis on the world-economy, the overall core/periphery hierarchy of the capitalist world-economy remained largely unchanged. Furthermore, the analysis of mobility along the core/periphery structure of exports and imports revealed that only a few countries in the middle tiers of the world-system experienced noticeable upward mobility in both structures of global trade after the crisis. Specifically, Vietnam, Myanmar, Bangladesh, and Ethiopia were the only four countries that achieved substantive upward mobility in both import-coreness and export-coreness. These findings have implications for understanding the emergence of these countries as semi-peripheral within the capitalist world-economy.

The rest of the paper is structured as follows: In the next section, I review the concepts of the semi-periphery and upward mobility in relation to the world-system. Subsequently, I describe the empirical framework, followed by a section discussing the empirical findings. Finally, I conclude with a presentation of the study's implications and areas for future research.

Trade Globalization and the Hierarchy of the World-System

A core tenet of world-systems theory is the understanding that the global capitalist economy exhibits a hierarchical structure, commonly referred to as a core/periphery structure. World-systems theory emphasizes the importance of analyzing economic foundations and within the capitalist world-economy, global trade flows represent one of the most significant economic relationships. Consequently, studies on the world-system and economic development highlight the significance of occupying an integrated core position in the global trade network, as it reflects power and status within the core/periphery structure and the broader world-economy (Snyder and Kick 1979; Smith and White 1992; Van Rossem 1996; Kim and Shin 2002; Mahutga 2006; Clark and Beckfield 2009; Clark 2010; Jacobs and Rossem 2016). Thus, the hierarchical core/periphery structure of the global trade network emerges from ongoing trade globalization, intensifying economic interdependence among countries.

Within the global trading network, the distribution of trade partners for a single nation-state is not uniform. However, it can serve as an approximation of the unequal power relations within

trade relationships. The core/periphery hierarchy in the global trading system theoretically reveals the significant disparity in economic power between core and non-core states. In today's globalized world, the reproduction of power occurs subtly through market mechanisms, with military force being utilized only when there is a challenge to the "rules" of the market that sustain core dominance in non-core regions (Chase-Dunn and Grimes 1995). Aligning with Clark (2010), the core/periphery hierarchy in the global trade network provides insights into the reproduction of power, the persistence of cross-national inequality, and the polarization of national economies on a global scale. According to the literature, the core/periphery structure shapes the opportunities and challenges faced by participating nation-states in their pursuit of national economic development. Consequently, a nation-state's level of coreness in the global trading system should have a positive impact on its economic growth. Highly integrated countries within the global trade network have greater access to resources and technology that fuel their economic development, while isolated nations in the periphery experience economic dependency and disarticulation (Chase-Dunn 1997; Mahutga 2006; Clark 2010; Mahutga and Smith 2011).

Expanding on this line of thinking, trade relations are generally characterized as exploitative, persisting due to the economic dependence of isolated nations in the periphery on their ties with the core. It is not only the number of trade relations that matters, but also the monetary volume associated with each relation. Core countries, situated in the core stratum, have a greater share of trade relations with larger volumes compared to peripheral countries, which may have a significant number of ties but with relatively weaker volumes. This disparity arises because peripheral countries heavily rely on specific core countries for their foreign trade, whereas core countries depend on relations with the entire global trading system (Wallerstein 1974; Chase-Dunn and Grimes 1995). As a result, core countries have strong connections with both core and non-core countries, participating in highly intense trade clusters with substantial volume distributions. In contrast, peripheral countries exhibit significant interconnections with core countries but are engaged in sparse trade clusters within the global trade network.

Semi-Peripheral Mobility Along the Core/Periphery Structure After an Economic Downturn

The semi-periphery, rather than simply being a middle category in the core/periphery hierarchy, plays a crucial structural role in the world-system and the capitalist world-economy as a whole. It facilitates the generation and appropriation of surpluses that flow from the periphery to the core, contributing to the development of core states. Positioned between the powerful core and the marginalized periphery, the semi-periphery serves as a political "buffer zone" that helps alleviate class tensions between the core and periphery while maintaining power asymmetries between core and non-core nations (Wallerstein 1974). Furthermore, in the context of this study, the semi-periphery ensures the system's flexibility and adaptability during economic downturns.

Semi-peripheral states are generally characterized by a combination of core and periphery characteristics and can include former core countries that have moved down in the hierarchy, or

peripheral countries that have moved up. Within world-systems theory, the semi-periphery has encompassed a range of economically and politically strong nation-states, including Latin American countries such as Brazil, Mexico, Argentina, and Venezuela, as well as European countries in the southern regions like Italy, Portugal, and Greece. The list also includes countries in North Africa, the Middle East (such as Algeria, Egypt, and Saudi Arabia), and Asia (such as India, Iran, China, and South Korea). The semi-periphery is a dynamic and volatile zone that serves as fertile ground for social, organizational, and technical innovation, as well as a strategic location for upward mobility and the establishment of new centers of resource control (Chase-Dunn 1988). It is within the semi-periphery that fundamentally innovative forms of organization and activities with diverse logics of operation are often observed (Chase-Dunn 1988). These changes frequently lead to upward mobility of certain semi-peripheral states along the core/periphery hierarchy (Chase-Dunn 1986). All core countries have semi-peripheral roots, and most older peripheries have improved their position in the world-system; however, numerous peripheral countries remain in marginalized positions.

Therefore, the semi-periphery is where we witness the emergence of potentially upwardly mobile states and the growth of future hegemons. Previous studies find that rapid economic growth in the semi-periphery often outpaces the growth of periphery and often the core, and therefore we can expect to see upward mobility vary by world-system zone (Clark and Beckfield 2009; Clark 2010; Mahutga and Smith 2011). Because semi-peripheral states contain a mixture of core and peripheral forms of organization and economy, they become more attractive sites for industrial migration. And because of their blend of core and periphery characteristics, semi-peripheral countries have lower labor costs than the core while their capacity to absorb and implement advanced production processes is higher than in the periphery. Subsequently, the semi-periphery is in an advantageous position to generate enough economic growth to spur upward mobility along the core/periphery hierarchy.

Upward mobility along the core/periphery hierarchy is generally regarded as a relatively intermittent phenomenon that is often limited in scope. The only option for non-core states to advance their relative position in the core/periphery is through "dependent development" (Evans 1979) on the core and even then, it is generally considered very rare to enter the core stratum (Chase-Dunn 1998). Smith and White (1992) and Mahutga (2006) each observed a few upwardly mobile cases that represented semi-peripheral entry into the core from 1965 to 1980. Furthermore, upward mobility along the core/periphery hierarchy is a zero-sum game. While some semi-peripheral states "progress," others "regress." Within the world-system, not all states can achieve upward mobility simultaneously because the system functions by virtue of having unequal core and peripheral regions (Wallerstein 1979; Arrighi and Drangel 1986). Semi-peripheral countries, therefore, compete with producers in the core by enhancing the cost advantages of locations within their jurisdictions. This competition, however, far from effectively upgrading the mix of core-peripheral activities within a semi-peripheral country, "is one of the mechanisms that turns core-like activities into peripheral activities and keeps the mix of the zone more or less even" (Arrighi and Drangel 1986: 27). Consequently, like a peripheral country's inability to escape their

association with peripheral activities, the absorption of core-like activities by semi-peripheral countries results in a "peripheralization" of those activities, thereby balancing out the advantages gained from adopting such production activities and undermining the capability of semi-peripheral countries to move into the core stratum (and of peripheral countries to move into the semi-periphery).

The global expansion of social processes of accumulation leads to the over-exhaustion of the world-economy, inevitably causing economic turmoil. The historical development of capitalism is due more to its "flexibility" and "eclecticism" and less to particular social systems fixed to a distinct and definite time and place (Braudel 1982, 1992). Crises are endemic due to the expansion of capitalism, but the system's flexibility and eclecticism makes it adaptable to severe economic downturns. According to Wallerstein (1979), structural crises are part of a series of Kondratieff Cycles that last an average of 40 to 60 years, characterized by alternating cycles of high sectoral growth and economic downturns. These cycles result in a "systemic consequence," where industrialized societies shift major industrial production zones to the periphery without undermining the existing core-periphery structure (Wallerstein 2011).

In the post-World War II era, core states disproportionately benefited from a wave of global economic upswing, known as the Kondratieff A phase (Wallerstein 1976, 1979). However, Wallerstein argued that between 1967 and 1973, the world-economy entered a Kondratieff B phase, marking the end of the post-World War II expansion and a "shift in relative profit advantage to the semi-peripheral nations" (Wallerstein 1976: 464). During economic downturns, "semi-peripheral countries can usually expand control of their home market at the expense of core producers and expand their access to neighboring peripheral markets, again at the expense of core producers" (Wallerstein 1976: 464). During such global economic downturns, we expect to see economic growth correlate with increases in industrial production within non-core areas relative to the core, while core countries maintain their longstanding position in the world-system. However, a second cyclical consequence that follows a crisis could be a positional change within the hierarchy of the world-economy, especially for semi-peripheral countries.

The semi-periphery plays a crucial role as a buffer zone during significant economic downturns, facilitating a "creative destruction" (Schumpeter 1954) within the world-system. When global economic downturns occur and the core struggles, the semi-periphery becomes a site for migration and innovation in production, trade, and profit-seeking activities. While this can generate some upward mobility, it does not fundamentally transform the system. The semi-periphery's function as a buffer zone within the hierarchy helps prevent a complete collapse of the world-system while fostering innovation in production and trade. Through these market-oriented innovations, the core maintains its monopolistic positions within the world-economy, and the core/periphery hierarchy withstands global economic downturns (Arrighi and Drangel 1986).

Previous studies have produced results consistent with Wallerstein's prediction of semi-peripheral upward mobility during an economic downturn. Studies by Kim and Shin (2001) and Mahutga and Smith (2011) both found that the highest rates of upward mobility were primarily concentrated in semi-peripheral countries between 1965 and 2000. Clark (2010) also discovered

that world-system mobility of middle-tiered countries positively influenced their economic growth from 1980 to 2000 but led to greater divergence between the lower and middle tiers of the core/periphery hierarchy. These findings reveal that the rapid economic growth of semi-peripheral states can be attributed to their uniquely high rates of upward mobility within the core/periphery structure, which is a function of their position in the world-system. What explains this phenomenon? Certain semi-peripheral countries benefit from the relocation of global industries from core to non-core zones during economic downturns. As a result, economic downturns affecting the core present the greatest opportunity for growth in semi-peripheral countries, as core producers seek cost advantages in non-core areas to offset losses during global economic uncertainty. However, this upward trend is concentrated in middle-tiered countries, while countries in the lowest and most exploited tiers often experience downward mobility or remain locked in their structural positions.

To gain a better understanding of the impact of the 2008–09 crisis on the relationship between the hierarchical structure of the world-system and upward mobility, it is important to consider the inherent asymmetries that exist within trade relationships. For example, certain industries such as garment and textiles, as well as electronics, have experienced shifts where large multinational corporations retain the research and development aspects of production while outsourcing labor-intensive, low value-added production activities to firms in poorer areas (Gereffi 1994, 1999; Gereffi and Fernandez-Stark 2010; Gereffi and Lee 2016). According to Boyd and his colleagues (2010), these shifts in the global organization of production activities from core to non-core areas result in asymmetries within trade relationships persisting over time. To capture these asymmetries, they distinguish between two types of behaviors within the core-periphery structure: import-coreness and export-coreness. Import-coreness refers to the extent to which a country imports, while export-coreness refers to the extent to which a country exports across the world-economy.

In their examination of the garment industry in 2000, Boyd and his colleagues (2010) observed that historically core countries exhibited higher levels of import-coreness than export-coreness. They also discovered that a high ranking in import-coreness is a better predictor of a high ranking in symmetrical (overall) coreness than a high ranking in export-coreness. Specifically, they found that historically core countries (e.g., the United States, UK, Germany, and France) had higher levels of import-coreness, while many historically non-core countries with the highest export-coreness did not rank very high in import-coreness.

Accordingly, it is worth exploring whether these trends are evident during moments of global economic downturn, particularly after the 2008–09 global economic crisis. Building on previous findings of Clark (2010), Mahutga (2006), and Mahutga and Smith (2011), it is expected that countries in the middle- and upper-middle tiers of the core-periphery structure will be better positioned to experience greater upward mobility following a global economic downturn due to their structural proximity to the core. Additionally, based on Boyd and his colleagues (2010)'s findings regarding import-coreness and export-coreness in the garment industry in 2000, there is a reasonable expectation that this upward mobility will be primarily observed in export-coreness

rather than import-coreness. Therefore, it is reasonable to expect that the number of peripheral and semi-peripheral countries experiencing significant upward mobility after the 2008–09 crisis will mostly be limited to export-coreness.

Conversely, considering the increased influence of large semi-peripheral countries such as China, India, Brazil, Singapore, and South Africa within the world-economic system throughout the crisis, and their growing domestic demand for global commodities, it is also reasonable to expect that more widely regarded semi-peripheral countries will experience greater upward mobility in import-coreness compared to their peripheral counterparts. From these expectations, I post the following testable hypotheses:

- H_1: The global trade network will exhibit a core-periphery structure after the 2008–09 crisis.
- H_2: Semi-peripheral countries will experience greater upward mobility in import-coreness than in export-coreness after the crisis.
- H_3: The number of peripheral and semi-peripheral countries that will experience upward mobility after the 2008–09 crisis will be confined mostly to export-coreness.

Data

To construct network data of international trade, I used publicly available data from the IMF's *Direction of Trade Statistics* (DOTS), which includes bilateral merchandise trade data for countries and territories over a 1948–2018 period (International Monetary Fund 2014). The IMF publishes these data annually and they are distributed as part their *Direction of Trade Statistics Yearbook*. DOTS data present the total value of exports and imports of all member countries of the IMF and are reported in U.S. dollars. Although the data sources give information on both exports and imports, a consensus within the literature is that import data are more accurate than export data (Kim and Shin 2002; Clark 2010; Mahutga 2013); therefore, I relied on the import data for this analysis, and thus import data was used to create both export and import data matrices. To create a matrix of exports from the import data I transposed the matrix of imports which reverses the direction of imports to reflect exports. Another way to put it, if trade amounts between countries were perfectly reported then country *i*'s report of the amount imported from country *j* would be equal to country *j*'s report of the amount exported to country *i*.

To impute missing data, if there was no available import data of country i from country j, I relied on the available reported export data. That is to say, if the amount that country *i* imported from country *j* were missing, then I used the amount country *j* exported to country *i*. In sum, 191 countries appear in this sample if they either reported imports every year; or I relied on export-data from the DOTS data for no more than one missing year. The full sample is representative of

all world regions.[1] In total, I constructed four asymmetrical (directed) matrices of international trade from 2007, 2009, 2011, and 2017. The columns and rows consist of 191 countries, and the cells represent the dollar volume (in US$100 million) transformed using log+1 transformation. The rows represent export (sender) relationships and columns represent import (receiver) relationships.

Methods

For this study, I apply social network analysis to examine upward mobility following the 2008–09 global economic crisis. Social network analysis has married well with the world-systems perspective, leading to a rich bank of empirical studies. Much of the literature focuses on 1.) the extent to which cross-national relational data exhibit a core-periphery structure (Mahutga 2006; Nemeth and Smith 1985); 2.) delineate boundaries between core and peripheral countries (Kick and Davis 2001); 3.) adjudicate between the core-periphery distinction as a discrete or continuous variable (Smith and White 1992); and 4.) assess the hypothesis that variable forms of "unequal exchange" occur across different zones in the core-periphery structure (Clark 2010; Mahutga and Smith 2011). Many of these studies apply social network analysis to study power disparities that exist within the world-economy. In social networks, a core-periphery structure often consists of two classes of nodes, namely a cohesive subgroup (the core) in which actors are maximally connected to each other and a second subgroup that is minimally connected to each other but broadly connected to the core, and ties between the two subgraphs are unconstrained (Borgatti and Everett 2000; Boyd, Fitzgerald, and Beck 2006).

To capture a core-periphery structure in the trade data, I applied a SVD method which would observe a tendency for the global trade network to conform to a core/periphery structure. SVD takes a high-dimensional, highly variable set of data points and reduces it to a lower dimensional space that exposes the substructure of the original data more clearly and then orders it from highest amount of variation explained to the least. However, to apply an SVD method requires a matrix where the diagonals contain relevant information. Most, if not all, international trade network data do not contain any information in the diagonals since a country cannot trade with itself. To overcome this limitation, I add relevant information into the diagonals by applying a similar strategy by Boyd and his colleagues (2010) to approximate data matrices with an expression

[1] This posed a challenge as numerous countries gained independence in the early 2000s. To ensure a consistent sample size across multiple time periods, I adopted a strategy of aggregating the trade flows of recently independent nation-states with their former republics' overall trade, following a similar approach by Mahutga (2013). For example, the republics of Serbia and Montenegro were previously part of a single federal and political unit known as the State Union of Serbia and Montenegro, which officially formed in 2003. In 2006, Montenegro seceded from the union, leading to the recognition of Serbia and Montenegro as independent states. Additionally, Kosovo declared its independence from Serbia in 2008. Consequently, I combined the trade data of Kosovo, Serbia, and Montenegro and categorized them under the country label of "Serbia and Montenegro," reflecting the name of its former republic, for all the time periods under investigation.

analogous to, but distinct from, an SVD matrix. This application of Minimum Residual SVD, or MINRES/SVD, produces three vectors that each represent the outgoing and incoming tendences of each country along with a third vector that summarizes the information from these tendencies.

This particular application of SVD treats the core-periphery structure as a continuum where actors with higher values of coreness tend to be highly interconnected while those with lower values tend to be sparsely interconnected with each other. I then empirically verify that the observed core-periphery structure in the data is far from what would be expected given certain network properties, or a "result of randomness."

Computationally, I conduct a SVD analysis on the global trade network at each time point (2007, 2009, 2011, and 2017). The *singular value decomposition* takes a real *m x n* matrix *A* and represents *A* as the product of three matrices:

$$A = UDV^t$$

The SVD decomposes the information contained in a data matrix into three matrices: *U* is an *m x n* orthogonal matrix that represent the left singular vectors of the original matrix *A*, and these vectors are ordered in decreasing order where the first column corresponds to the data that explains the most variation and the second column corresponds to the data that explains the second most variation, and so-on. The *V* matrix is an orthogonal *n x n* matrix that represent the right singular vectors of the original matrix *A*, and are ordered similarly to the left singular vectors of *U*. Finally, a *m x n* diagonal matrix *D* contain the *singular values* of the original matrix *A* which summarize the information in the *U* and *V* matrices, which are non-negative real numbers. *D* contains elements d_i, or the singular values, and are ordered ($d_1 \geq \cdots \geq d_r > 0$) from the highest to lowest amount of variance explained by each dimension of U and V.

From the *U* and *V* matrices that contain singular vectors, I use the first left and right singular vectors that are associated with the largest singular values as they explain the most variation, and are my measures of coreness. From the SVD I assign coordinates of in (import)- coreness based on the derived singular values from the V matrix, and out (export)- coreness from the singular values from the U matrix. The singular values from D are then used to detect a core-periphery structure by finding the percent sum of squares on each dimension and observing the amount of variance explained by the first dimension d_1 relative to the other dimensions ($d_1 \geq d_2 \ldots d_8$). In summary, *U*'s singular vectors represent import-coreness, while *V*'s singular vectors represent export-coreness. These measures indicate one's structural position within the global trade network, approximating their placement in the core/periphery hierarchy of the world-system. This empirical approach not only confirms the theoretical prediction of the world-system but also enhances world-systems literature by distinguishing between import-coreness and export-coreness in a manner consistent with the hierarchy of the new international division of labor.

To evaluate the stability of the core-periphery structure, I calculated Pearson's correlation coefficients (r) for both the *V* and *U* vectors derived from the SVD across each time-period. This analysis aimed to examine the inter-year correlations of each coreness measure. High and positive

correlations would indicate strong long-term structural stability in the data, while weak and statistically non-significant coefficients would suggest less structural stability (Mahutga 2006).

Another goal of this study was to explore how opportunities or lack thereof after the 2008–2009 global economic crisis afforded semi-peripheral countries opportunities to mobilize along the hierarchy. To observe these trends longitudinally I compared the structure prior to the crisis (2007) and in multiple time points afterwards (2009, 2011, 2017) rather than solely during the crisis. Subsequently, mobility across the period of the crisis was assessed in the following two ways.

First, after the SVD assigns coordinates to each country, these coordinates were utilized as a measure of position within the global trade network. I assigned ranks to each country at multiple time points and the rank order is derived from the assigned coordinates of each country in the *V* and *U* vectors. I then order countries from the highest rank (or highest coreness) to the lowest (or lowest coreness). An advantage of using rank ordering is that it simplifies the measures obtained from the SVD into a sequence of non-negative ordinal numbers. These numbers approximate a rank order along the core/periphery hierarchy and are sorted in descending order, with larger values indicating higher coreness and lower values indicating lower coreness (or a more periphery-like position). For example, out of 191 countries, a core country like the United States would rank 191, whereas a historically peripheral country like Togo would be ranked closer to 1. I assigned rank-ordered positions for both import- and export-coreness across each time-period, which allowed for the evaluation and comparison of core status levels over time.

The second step is to examine patterns of mobility in the post-crisis era. Mobility is measured as the change in rank ordered position between years in each country. Specifically, mobility is measured as a change score that is computed as the difference in rank order position in 2017 minus the rank score in time 2007. Comparing rank order in 2007 provides a pre-crisis baseline to compare change in the post-crisis era. The change score is then sorted in descending order from largest positive change to largest negative change. I then sort the largest positive and negative changes in rank order and focus on the top 25 percent of countries with the most substantial positive changes. This approach will assess which countries along the core/periphery hierarchy were better positioned to experience greater upward mobility. Moreover, I will observe patterns of mobility across import- and export-coreness to test my second hypothesis.

Conditional Uniform Graph (CUG) Test for Core-Periphery Structure

The goal is to determine whether the observed core-periphery structure is "typical" of networks with similar network characteristics. In the context of core-periphery structures in trade networks, a null hypothesis would expect that an observed core-periphery structure was drawn from a single distribution, and that any distinguishable pattern drawn from the data arose from random sampling processes. Using conditional uniform graph (CUG) tests, I empirically test the discrepancy between observed core-periphery structures versus those that would de due to random chance. More precisely, CUG tests examine the extent to which higher-order features of a network (such

as reciprocity, transitivity, centralization) are influenced by lower-order features (such as size and density) that can vary across multiple network populations (Butts 2006, 2011; Faust 2007).

CUG values are estimated using Monte Carlo simulation procedures that then provide a baseline distribution to test a null model. Such distribution is constructed from 100 random graphs each with the same number of nodes as the observed network (N = 191) and the same value of the graph properties on which the distribution is conditioned (Holland and Leinhardt 1974; Wasserman and Faust 1994). For each random graph, the proportion of variance accounted for by the first dimension of the SVD model for a core-periphery structure will be compared to a baseline distribution of graphs with similar network properties.

It is also necessary to compute the proportion of results in the random graphs that are less than or equal to the observed results ($P(X \leq Obs)$) and the proportion of results in the random graphs with values that are greater than or equal to the observed result ($P(X \geq Obs)$), and these are analogous to randomized p-values (see Butts 2011 for a detailed mathematical explanation). This formulation measures the probability of observing a higher-order feature of a network given some lower-order property within the same network. Observations far from the baseline distribution are considered significantly far from random chance and not solely attributable to underlying low-order properties within the network.

For this study, I considered a null model for examining the core-periphery structure in the trade network at each point in time and conditioning the CUG values on the U|MAN distribution, or dyad census, of the observed network in each year of observation. The dyad census classifies each dyad into either the mutual, asymmetric, or null categories, then counts the number of each within the observed network. Following Holland and Leinhardt (1977) I drew a dyad census that considered each dyad in a directed graph to be in one of three states: the null state (empty dyad), a complete or mutual state ($a \longleftrightarrow b$), and either of two asymmetrical ties ($a \rightarrow b$ or $a \leftarrow b$). I conditioned each of the 100 random graphs to the dyad census of the observed trade network, which in turn generated random graphs that have the same dyad census as the observed network.[2] This dyad classification for each year was then used to condition the random graphs. These random graphs underwent a comparable SVD analysis to the observed network, extracting their first dimensions and determining the variance each dimension explained. This process established a reference distribution, serving as the baseline for the null hypothesis (Butts 2008b). In this core-periphery CUG test, the alternative hypothesis posits that the observed core-periphery structure in the data is not attributable to low-order properties or "random chance" of the network.

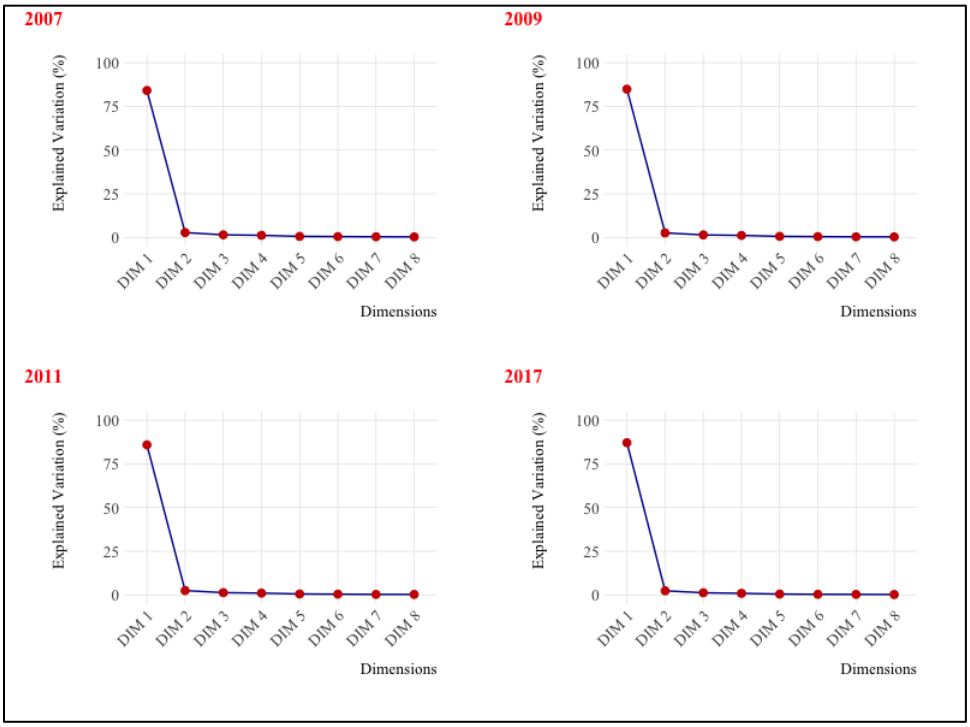
[2] Since the dyad census is applicable to only dichotomous (0/1) network data, I dichotomized the valued trade relations within the global trade network by considering only trade relations that generated an annual volume of trade of more than or equal to US$100 million in each year, and anything below that threshold was considered as an "absence of a trade tie."

Results

The Core-Periphery Structure of the Global Trade Network

Findings from the SVD analysis confirm the presence and persistence of a core/periphery structure in the global trade network over time. Figure 1 compares the percentage of variation explained by the first eight dimensions of *D* over time. The X and Y axes represent the dimensions and the respective percentage of variation explained, relative to the other dimensions. As shown, in each time-period, the first dimension d_1 contained the highest percentage of variance explained, noticeably surpassing the subsequent seven dimensions. This displays an extremely large amount of variation that is explained in the first dimension of each time-period and fulfills the expectation of a core-periphery structure in the trade data. This consistency aligns with previous research that used SVD and observed a strong association between high variance explained by the first dimension and a core/periphery structure (Borgatti and Everett 2000; Mahutga 2006; Lloyd, Mahutga, and de Leeuw 2009).

Figure 1. Percent of Variance Explained in First 8 Dimensions



The CUG tests unveil a significant core-periphery structure in each year that cannot be accounted for by the dyad census of the observed network. This finding suggests a non-random pattern. Figure 2 depicts the CUG test plot, which compares the observed explained variation in the first dimension (represented by the red line) across each time-period with a randomly generated distribution (N = 100) of first dimensions and their corresponding explained variation. In all years,

there were no random cases with greater than or equal core-periphery values observed (proportion ≈ 0.0), while all random cases had less than or equal core-periphery values observed (proportion ≈ 1.0). The observed percentage of variance explained by the first dimension in each time-period is more pronounced than what would be expected based on the dyad census of the observed network. In other words, the likelihood of observing this pattern solely due to lower-order properties or random chance is highly improbable.

Figure 2. CUG Test Plots for Core/Periphery Structure

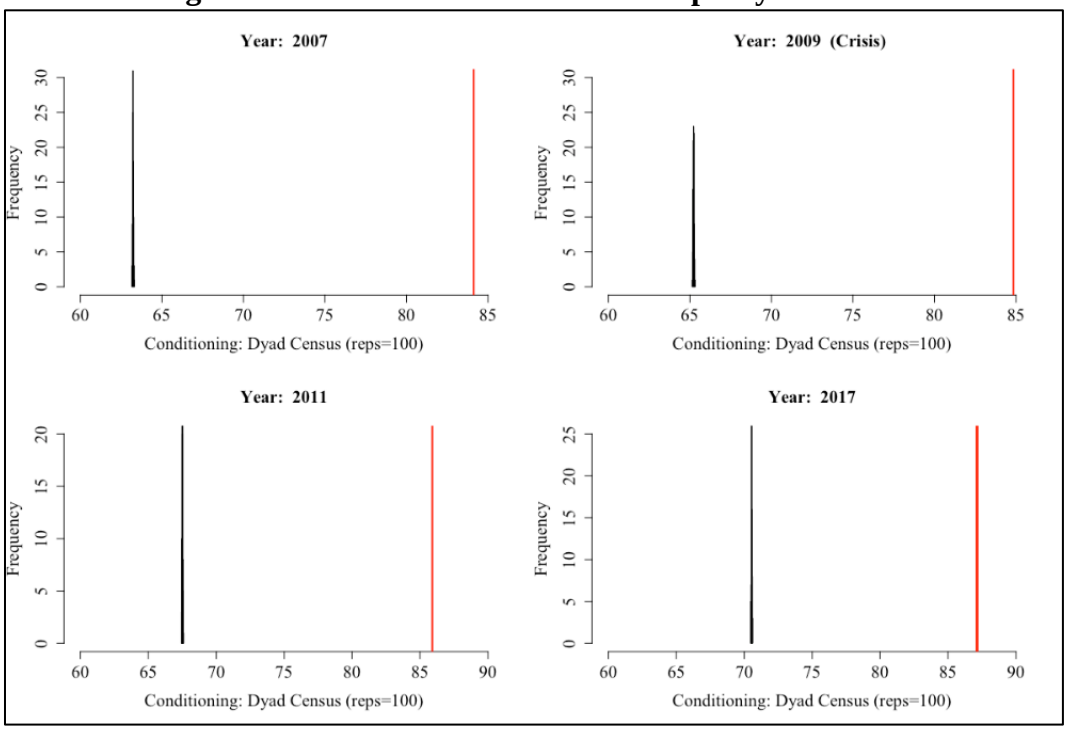


Table 1 presents the descriptive statistics for import-coreness and export-coreness over time. Import-coreness exhibits a negative skewness, in contrast to export-coreness, which displays a positive skewness. For import-coreness, a few countries with small values pull the mean towards the lower end of the distribution. Consequently, the distribution extends towards lower values, while most values are concentrated towards the higher end. Conversely, in the case of export-coreness, the distribution extends towards higher values, causing the mean to shift towards the higher end of the distribution, while most values are concentrated towards the lower end. This is perhaps a product of the asymmetry that comes with import and export relations. Moreover, the standard deviation indicates a relatively higher variation within export-coreness compared to import-coreness, although the magnitude of each standard deviation decreases over time.

Table 1. Descriptive Statistics of SVD Coordinates for Import- and Export-Coreness

Import-Coreness					
Year	Mean	Median	Max	Min	Std Dev
2007	0.67	0.68	0.1241	0.0001	0.273
2009	0.675	0.676	0.1213	0.0001	0.26
2011	0.677	0.69	0.119	0.0001	0.257
2017	0.681	0.696	0.1172	0.0001	0.245
Export-Coreness					
Year	Mean	Median	Max	Min	Std Dev
2007	0.661	0.626	0.1267	0.058	0.296
2009	0.661	0.62	0.1263	0.056	0.296
2011	0.665	0.655	0.1247	0.063	0.285
2017	0.671	0.66	0.1241	0.138	0.273

Table 2 displays the correlation matrices of each coreness measure and indicate strong positive correlations over time. In each correlation matrix, most correlation coefficients are near +1.0 ($r \geq 0.9$), a near perfect positive correlation, and are all statistically significant at a $p < 0.0001$. This implies that countries with high coreness in one time-period displayed high coreness over time and appeared consistent across each type of coreness. Put another way, the correlation coefficients display strong and statistically significant correlation within each coreness measure across time, thereby providing further evidence of structural stability.

Table 2. Pearson Correlation Coefficients of Import- and Export-Coreness Over Time

Import-Coreness (V)			
	2007	2009	2011
2009	0.986****		
2011	0.977****	0.991****	
2017	0.945****	0.953****	0.967****
Export-Coreness (U)			
	2007	2009	2011
2009	0.998****		
2011	0.994****	0.997****	
2017	0.983****	0.988****	0.992****

Note: **** Correlation is significant at $p < 0.001$; two-tailed test

Table 3 display the intra- and inter-year correlations between rank order positions of import- and export-coreness. These correlation coefficients demonstrate that the ordering in import-coreness is strongly and positively correlated with the ordering in export-coreness across the period of observation. The findings in Tables 2 and 3 are consistent with Mahutga's (2006) findings that inter-year correlations of structural position are indicative of structural stability over time.

Table 3. Intra- and Inter-Year Correlations of Import (V)- and Export (U)-Coreness Coordinates

	V-2007	U-2007	V-2009	U-2009	V-2011	U-2011	V-2017
U-2007	0.877****						
V-2009	0.986****	0.863****					
U-2009	0.879****	0.998****	0.867****				
V-2011	0.977****	0.869****	0.991****	0.874****			
U-2011	0.878****	0.994****	0.866****	0.997****	0.876****		
V-2017	0.945****	0.853****	0.953****	0.860****	0.967****	0.862****	
U-2017	0.878****	0.983****	0.864****	0.988****	0.876****	0.992****	0.871****

Note: **** Correlation is significant at $p < 0.001$; two-tailed test

I derive two important findings from these results. First, the percent variance on the first singular vector and the CUG tests shows the strong presence of a core/periphery structure in each year. Second, the correlations displayed in Tables 2 and 3 show that the ordering is very stable; meaning countries largely remained in the same positions over the period of observation. Together these findings provide robust evidence that the global trade network operates within the confines of a hierarchical, core/periphery structure.

Figures 3a–3d illustrate the SVD coordinates of import-coreness and export-coreness, represented on the X and Y-axis respectively. These figures provide a comprehensive depiction of the aggregate core/periphery structure for each time-period. The countries located at the upper right corner of the graph represent the countries that are most like the core in both import- and export-coreness, while the countries at the lower left corner represent the most peripheral countries. Many countries do not fall on or relatively near the 45-degree line from the bottom left to top right, which indicates relatively similar import- and export-coreness. Instead, there are differences in import- and export-coreness scores for many countries, and some of these differences are relatively large. Countries in the upper tiers of aggregate core/periphery structure appear above the 45-degree line, which indicates higher export-coreness than import-coreness. When moving down the 45-degree line, the pattern shifts the other way. In the middle and lower-tiers, more countries appear below the 45-degree line, which indicates higher import-coreness than export-coreness. Furthermore, starting from 2009, countries began to cluster relatively closer to the 45-degree line, indicating a balance between import- and export-coreness. However, it is worth noting that more countries in the middle and lower tiers still appear below the line.

Figure 3a. SVD Coordinates of Import- and Export-Coreness, 2007

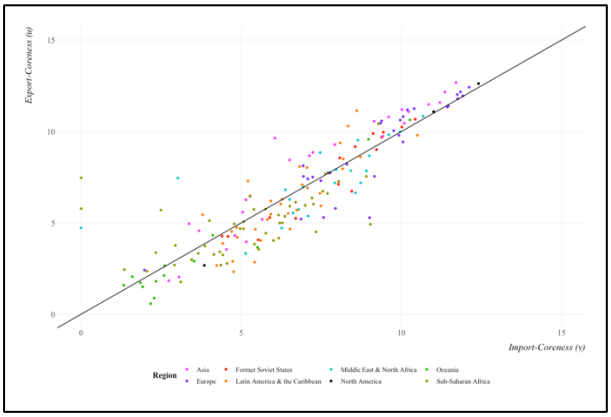


Figure 3b. SVD Coordinates of Import- and Export-Coreness, 2009

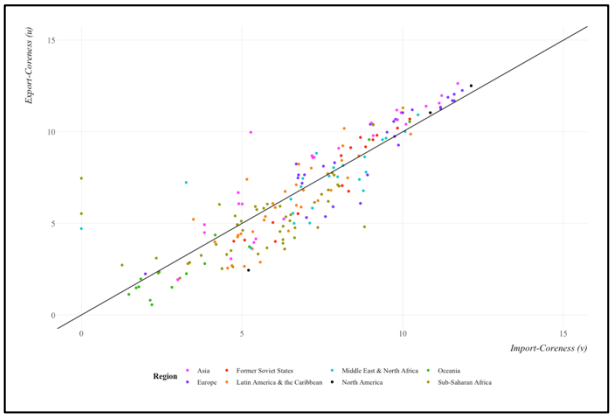


Figure 3c. SVD Coordinates of Import- and Export-Coreness, 2011

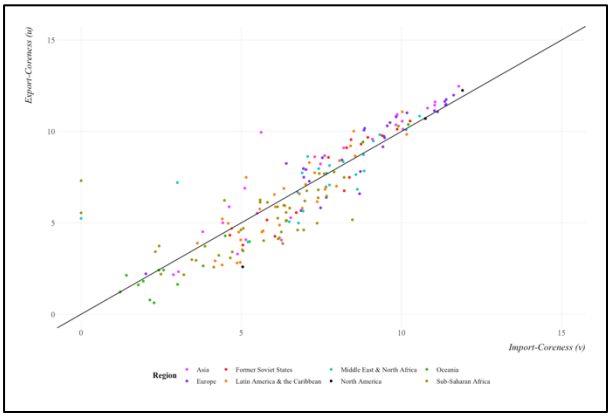
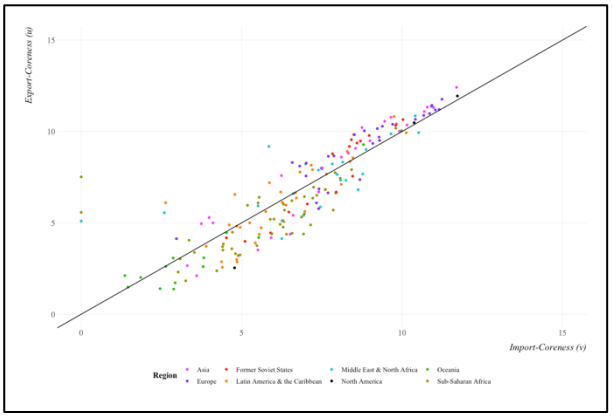


Figure 3d. SVD Coordinates of Import- and Export-Coreness, 2017



This observation of clustering near the 45-degree line aligns with the decrease in the standard deviation for import- and export-coreness, as shown in Table 1. These findings suggest that a country's export-coreness score holds greater relevance to its global position than its import-coreness score when considering its placement within the hierarchy of the core/periphery structure.

Mobility Along Core/Periphery Structure, 2007–2017

The previous section unveiled that the world-economy is organized into a core/periphery hierarchy, which demonstrated a relatively stable pattern in the aftermath of the 2008–09 global economic crisis. Therefore, analyzing mobility patterns offers another perspective to evaluate the potential changes following the 2008–09 global economic crisis and the evolving international division of labor. If countries tend to transition from lower to higher levels within the core/periphery hierarchy, it implies a decrease in structural inequality. Conversely, if the unequal structure exhibits limited long-term upward mobility, it signifies a persisting stability in structural inequality.

Table 4 presents the upward and downward mobility, measured as the change in rank order position from 2007 to 2017, for the top ten countries in the hierarchy. Looking at the entire system, there is a high level of continuity. The correlation coefficients displayed in Tables 2 and 3 indicate that the structural position of countries remained highly stable from 2007 to 2017, with a tendency for greater stability at the top of the structure. In terms of import-coreness, all of the top ten countries, except for China, are high-income countries. Specifically, the United States, Germany, the Netherlands, the United Kingdom, and France consistently rank among the top countries in import-coreness for both 2007 and 2017. In contrast, three countries from the global South, namely China, India, and South Korea, make it to the top ten in export-coreness. This aligns with the theoretical expectation that historically semi-peripheral countries would have more influence in export-coreness than import-coreness. However, I also anticipated that larger emerging semi-peripheral countries, such as China and India, would gain greater influence within import-coreness following the 2009 crisis, given the severe impact of the 2008–09 global economic crisis on the United States, Western Europe, and Japan. This expectation is reflected in the noticeable upward mobility of China and India in import-coreness between 2007 and 2017. Furthermore, the rank changes presented in the far-right of the table for both import- and export-coreness indicate minimal changes, further implying structural stability at the very top of each hierarchy.

Table 4. Top 10 Countries in 2007 and 2017 on Import- and Export-Coreness

Import-Coreness				
Country	Region	2007 Rank	2017 Ranked	Rank Change
United States	North America	191	191	0
Germany	Europe	190	189	-1
United Kingdom	Europe	189	187	-2
France	Europe	188	185	-3
Netherlands	Europe	187	188	1
Italy	Europe	186	184	-2
China	Asia	185	190	5
Belgium	Europe	184	180	-4
Spain	Europe	183	183	0
Japan	Asia	182	182	0
Export-Coreness				
Country	Region	2007 Rank	2017 Ranked	Rank Change
China	Asia	191	191	0
United States	North America	190	190	0
Germany	Europe	189	189	0
France	Europe	188	188	0
Japan	Asia	187	186	-1
Italy	Europe	186	187	1
United Kingdom	Europe	185	183	-2
Netherlands	Europe	184	184	0
India	Asia	183	185	2
Korea, South	Asia	182	182	0
Notes: Countries arranged from highest to lowest in 2007				

Figures 4a and 4b depict scatterplots illustrating the core/periphery position in relation to world-system mobility during the 2007–2017 period for the 191 countries included in the sample. Both figures feature a fitted line starting at 0, indicating no changes in rank order position over the 10-year period. While my conceptualization of world-systems position is continuous, I have identified at least five clusters corresponding to the core, semi-peripheral, and peripheral zones. The specific demarcation of these clusters is widely discussed in the world-systems literature, with scholars proposing different numbers of groups. For instance, Smith and White (1992) demarcate five clusters, while Mahutga and Smith (2011) demarcate six clusters. In this study, I have demarcated the clusters based on percentiles: the upper 5 percent representing the core, the range of 94 percent to 75 percent representing the upper semi-periphery, the range of 74 percent to 50 percent representing the lower semi-periphery, the range of 49 percent to 25 percent representing the upper periphery, and below 25 percent representing the lower periphery. The demarcation is theoretically informed, although practically arbitrary. Table 5 provides descriptive statistics for rank changes in import-coreness and export-coreness during the same period.

As shown in both Figures 4a and 4b, a small number of countries exhibit notable rank changes in export-coreness, while in import-coreness, more countries display substantial rank changes, both positive and negative. Regarding import-coreness, it appears that position changes vary more within the lower-middle and middle tiers of the core/periphery structure compared to the upper tiers, but the lowest tiers appear to be relatively more stable. In contrast, more countries cluster around the 0 line in export-coreness compared to import-coreness, suggesting less change and greater positional stability in export-coreness. This is supported by the descriptive statistics presented in Table 4. The mean, median, and mode of rank change in import-coreness indicate larger average rank changes, and the larger standard deviation reflects greater variation in rank positioning. Furthermore, Figure 4a highlights at least 6 countries that experienced a significant positive rank change of over 50 in import-coreness, while 2 countries (Egypt and Nicaragua) encountered a substantial negative rank change of 50 or more in import-coreness.

Overall, Figures 4a and 4b highlight the competition that exists between peripheral and semi-peripheral countries in their pursuit of upward mobility. While certain peripheral and semi-peripheral countries did experience improvements in their social standing, these positive changes were accompanied by a notable downward mobility for other peripheral and semi-peripheral nations. Furthermore, countries in the highest and lowest tiers observed minimal, if any, changes in their structural positions, emphasizing the enduring presence of structural inequality within the global economy. Findings presented in Tables 4 and 5 show that there was more positional stability within export-coreness than in import-coreness, especially within the very top of the core/periphery structure.

Figure 4a. Mobility in Import-Coreness (2007–2017)

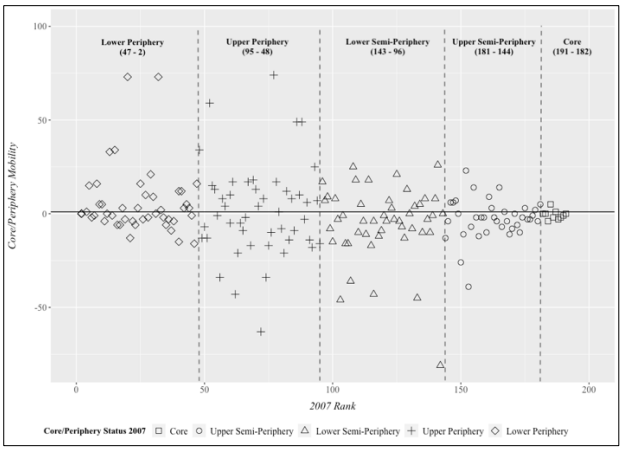


Figure 4b. Mobility in Export-Coreness (2007–2017)

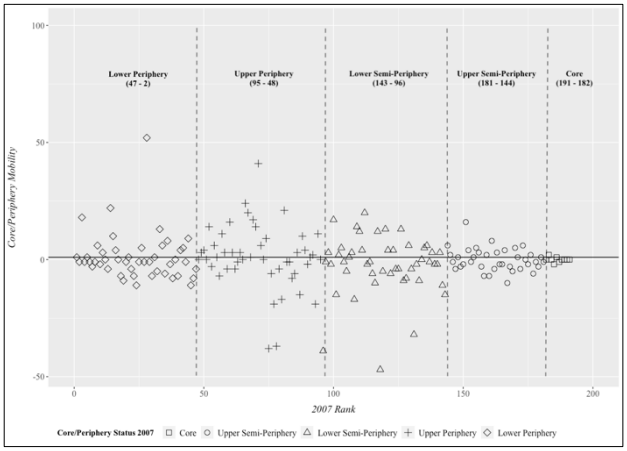


Table 5. Descriptive Statistics of Rank Changes for Import- and Export-Coreness (2007–2017)

	Mean	Median	Mode	Std. Dev	Min	Max
Import-Coreness	14.92	9	5	16.91	1	74
Export-Coreness	7.8	5	1	8.57	1	52

Previous studies examining the network of world trade have focused on the growing influence of East Asian countries within the core/periphery hierarchy (Kim and Shin 2002; Mahutga 2006; Clark 2010) due to the region's significant economic growth since the latter half of the twentieth century (Firebaugh and Goesling 2004; Milanovic 2005). However, these studies relied on trade network data that focus on the second half of the twentieth century, failing to capture the globalization trends of the twenty-first century that have had substantial impacts on Africa, South Asia, the Middle East and North Africa, former Soviet States, and Latin America. The findings presented in this paper make a valuable contribution to the existing literature by demonstrating that while East Asian countries have continued to rise in prominence, countries from other regions have also gained influenced within the world-economy.

Tables 6a and 6b present the countries that experienced the largest positive rank changes in import-coreness and export-coreness, respectively, from 2007 to 2017. Table 6a shows that six countries underwent upward mobility in import-coreness, transitioning from the periphery to the semi-periphery status (Vietnam, Mozambique, Myanmar, Bangladesh, Bahrain, and Ethiopia). Consequently, by 2017, there were 16 semi-peripheral countries compared to 9 in 2007. In contrast, Table 6b reveals that four countries experienced upward mobility in export-coreness that resulted in a substantial change in position status (Serbia and Montenegro, Myanmar, Bosnia and Herzegovina, and Ethiopia). As a result, by 2017, there were 13 semi-peripheral countries compared to 10 in 2007. Additionally, 9 countries are in the top 30 of rank change for both import- and export-coreness (Mozambique, Marshall Islands, Vietnam, Rwanda, Lesotho, Burkina Faso,

Myanmar, Ethiopia, and Bangladesh), but only 4 are in both the semi-periphery within import- and export-coreness in 2017 (Vietnam, Myanmar, Bangladesh, and Ethiopia).

In Table 6a, we observed an increase of upper semi-peripheral countries in import-coreness, from three in 2007 to six in 2017; whereas there were only two upper semi-peripheral countries in both 2007 and 2017 within export-coreness. Two countries who became upper semi-periphery countries by 2017 (Brazil and the Philippines) are widely recognized as emerging semi-peripheral countries, whereas Vietnam has been widely considered a peripheral country. Additionally, there were four new lower semi-peripheral countries in both import-coreness and export-coreness, but the number of lower semi-peripheral countries is slightly larger in export-coreness (12) than in import-coreness (10).

Table 6a. Top 30 Countries with Largest Rank Change in Import-Coreness

	2007 Rank	2017 Rank	Rank Change
Vietnam*	77 (UP)	151 (USP)	74
Mozambique*	32 (LP)	105 (LSP)	73
Burkina Faso	20 (LP)	93 (UP)	73
Myanmar*	52 (UP)	111 (LSP)	59
Bangladesh*	88 (UP)	137 (LSP)	49
Bahrain*	86 (UP)	135 (LSP)	49
Mongolia	48 (UP)	82 (UP)	34
Eswatini	15 (LP)	49 (UP)	34
Burundi	13 (LP)	46 (LP)	33
Brazil	141 (LSP)	167 (USP)	26
Sri Lanka	108 (LSP)	133 (LSP)	25
Ethiopia*	93 (UP)	118 (LSP)	25
Singapore	152 (USP)	175 (USP)	23
Philippines	125 (LSP)	146 (USP)	21
Bahamas	29 (LP)	50 (UP)	21
Dominican Republic	114 (LSP)	132 (LSP)	18
Cameroon	109 (LSP)	127 (LSP)	18
Nepal	69 (UP)	87 (UP)	18
Azerbaijan	96 (LSP)	113 (LSP)	17
Zambia	78 (UP)	95 (UP)	17
Rwanda	67 (UP)	84 (UP)	17
Malawi	61 (UP)	78 (UP)	17
Sierra Leone	47 (LP)	63 (UP)	16
Somalia	25 (LP)	41 (LP)	16
Marshall Islands	8 (LP)	24 (UP)	16
Seychelles	53 (UP)	68 (UP)	15
Lesotho	5 (LP)	20 (LP)	15
United Arab Emirates	165 (USP)	179 (USP)	14
South Africa	155 (USP)	169 (USP)	14
Belarus	129 (LSP)	142 (LSP)	13

Note: LP – Lower Periphery; UP – Upper Periphery; LSP – Lower Semi-Periphery; USP – Upper Semi-Periphery
** Indicates a substantial change in position (e.g., from Periphery to Semi-Periphery)*

Table 6b. Top 30 Countries with Largest Rank Change in Export-Coreness

	2007 Rank	2017 Rank	Rank Change
Sudan	28 (LP)	80 (UP)	52
Serbia & Montenegro*	71 (UP)	112 (LSP)	41
Mozambique	66 (UP)	90 (UP)	24
San Marino	14 (LP)	36 (LP)	22
Myanmar*	81 (UP)	102 (LSP)	21
Nicaragua	67 (UP)	87 (UP)	20
Qatar	112 (LSP)	132 (LSP)	20
Marshall Islands	3 (LP)	21 (LP)	18
Albania	69 (UP)	86 (UP)	17
Cambodia	100 (LSP)	117 (LSP)	17
Angola	60 (UP)	76 (UP)	16
Vietnam	151 (USP)	167 (USP)	16
Laos	52 (UP)	66 (UP)	14
Moldova	70 (UP)	84 (UP)	14
Oman	109 (LSP)	123 (LSP)	14
Latvia	120 (LSP)	133 (LSP)	13
Lithuania	126 (LSP)	139 (LSP)	13
Rwanda	33 (LP)	46 (LP)	13
Estonia	117 (LSP)	129 (LSP)	12
Guatemala	110 (LSP)	122 (LSP)	12
Ethiopia*	94 (UP)	105 (LSP)	11
Iraq	57 (UP)	68 (UP)	11
Bosnia & Herzegovina*	88 (UP)	98 (LSP)	10
Lesotho	15 (LP)	25 (LP)	10
Gabon	74 (UP)	83 (UP)	9
Haiti	44 (LP)	53 (UP)	9
Burkina Faso	36 (LP)	44 (LP)	8
Poland	161 (USP)	169 (USP)	8
Bangladesh	136 (LSP)	142 (LSP)	6
Barbados	54 (UP)	60 (UP)	6

Note: LP – Lower Periphery; UP – Upper Periphery; LSP – Lower Semi-Periphery; USP – Upper Semi-Periphery; 7 to 6
** Indicates a substantial change in position (e.g., from Periphery to Semi-Periphery)*

Overall, these findings support Hypothesis 2 but not Hypothesis 3. Widely considered semi-peripheral countries showed upward movement in the hierarchy in terms of import-coreness rather than export-coreness, while more peripheral countries experienced a significant change in position, transitioning from periphery to semi-periphery status in terms of import-coreness rather than export-coreness. However, it is worth noting the slightly higher presence of lower semi-peripheral countries in export-coreness compared to import-coreness. This suggests that a greater number of semi-peripheral countries, particularly those closer to the lower tiers of the hierarchy, continue to achieve upward mobility through exports rather than imports. This lends support to the theoretical expectation that lower-tiered countries (both peripheral and semi-peripheral) can still achieve

mobility by increasing their global share of exports. Nevertheless, it is the semi-periphery and peripheral countries near the semi-peripheral zones that witnessed the most noticeable upward mobility after the crisis period.

Conclusion

This study aimed to investigate whether there were indications of profound changes within the core/periphery hierarchy or if it remained stable. Additionally, I assessed whether mobility within the post-crisis era varied based on structural position. The study yielded several noteworthy findings regarding the impact of the crisis on the hierarchy of the global trade network. The first dimension of the SVD analysis offered a substantial structural measure of the global trade network, capturing its persistent and stable hierarchical nature, which strongly correlates with the core/periphery concept from world-systems theory. The CUG tests empirically confirmed that the observed core-periphery structures across each period deviated significantly from what would be expected based on the lower-order properties of the trade network. The remarkably strong and statistically significant Pearson *r* correlation coefficients of structural positions throughout the observation period provide compelling evidence that the core/periphery hierarchy remained stable following the 2008–09 crisis.

The findings also suggest that the 2008–09 global economic crisis was followed by upward mobility for a few peripheral and semi-peripheral countries. Despite the severe impact of the crisis on core members such as the United States, the United Kingdom, and Japan, their positions within the core/periphery hierarchy remained relatively unaffected. Thus, core countries and semi-peripheral countries closer to the core in both import-coreness and export-coreness structures maintained a relatively stable position. In contrast, many peripheral and lower-tiered semi-peripheral countries remained marginalized within the world-economy, competing against each other for gains in the core/periphery hierarchy. Only a few countries achieved substantial upward mobility, indicating that such mobility remains the exception rather than the norm in the twenty-first century. Furthermore, by differentiating between import-coreness and export-coreness, I demonstrated that substantive upward mobility within the world-system necessitates improvement in both import-coreness *and* export-coreness statuses.

In terms of substance, the findings challenge the expectation of a profound change within the global economic order. Despite theoretical predictions of a significant structural shift in the core/periphery hierarchy following the 2008–09 global economic crisis, the results of this study suggest otherwise. The findings indicate that the hierarchy remained resilient to the crisis, even though it did impact the major markets of the core and semi-periphery. Additionally, Vietnam, Myanmar, Bangladesh, and Ethiopia were the only four countries that achieved noticeable upward mobility in both import-coreness and export-coreness. Consequently, these results align with Robinson's (2015, 2017) argument that the 2008–09 global economic crisis and the rise of the BRICS should not be viewed as dismantling the old hierarchical systems of capitalist globalization. Instead, they underscore the fact that globalization continues to be characterized by interrelated,

contingent, and unequal transformations that uphold structural inequalities between affluent and impoverished countries. Therefore, it is important to understand the observed events or potential changes in the context of globalized power relations and the social structures that have evolved over time.

In conclusion, future research on the consequences of crises on globalization can benefit from efforts to generalize the impact of these major crises on the world-economy. Although this study had limitations in focusing on aggregate trade and production rather than specific sectors or industries, there are valuable insights to be gained from analyzing aggregate trade data to develop a clearer understanding of how a global economic crisis affects the entire global trading system. Subsequent studies should investigate whether structural mobility affected economic development at the micro-level of the world-economy after the 2008–09 crisis, as well as consider factors beyond income, such as health outcomes, in assessing the standard of living. Exploring these types of questions will enhance our understanding of the impact of various economic crises, including currency crises, debt crises, inflation crises, and more.

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